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ABSTRACT

Studies are reviewed in which the State Trait Anxiety Inventory (STAI) was used to measure anxiety about teaching science in preservice elementary school teachers during required science content courses. STAI measures state anxiety (transitory emotional state influenced by training) and trait anxiety (relatively stable individual difference in anxiety proneness). Correlation coefficients for administrations of X and Y forms of the STAI ranged from 0.93 to 0.94. Means and standard deviations for all administrations from 1977-1981 are reported. Many students expressed interest in workshops to reduce anxiety about science and science teaching. However, when such a workshop was made available, few were able to attend because of lack of time in their schedules. Although the small sample size (workshop participants) obviated attempts at experimental research, the results were sufficient to encourage additional systematic investigations. (Author/JN)

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BASIC STUDIES ON ANXIETY ABOUT TEACHING SCIENCE IN PRESERVICE ELEMENTARY TEACHERS

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Abstract

Review of studies from 1977-1981 in which the State Trait Anxiety Inventory (STAI) was used to measure anxiety about teaching science in preservice elementary teachers during required science content courses.

Correlation coefficients for administrations of the X and Y forms of the STAI ranged from .93 to .94. Means and standard deviations for all administrations for both forms of the STAI are reported.

Many students expressed interest in workshops to reduce anxiety about science and science teaching. However, when such a workshop was made available, few were able to attend because of lack of time in the schedules. Although the small sample size obviated any attempts at experimental research, the results were sufficient to encourate more systematic investigation.

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The format and atmosphere of a symposia permits discussion and interchange of ideas and the formulation of new avenues of research which would be difficult or impossible in a more formal environment.

This presentation will focus on the major trends found in the past five years of research at C. W. Post College. Statistical data previously reported or currently under review for publication will not be presented. We would like to share with you the rationale for the studies, some of our learning experiences and our future plans.

Five years ago, when I (Westerback) began work on my doctoral dissertation, it was impossible to imagine that today I would be part of a panel seeking answers to questions raised at that time. These issues would not have come to mind if Dr. F. James Rutherford and his successor Dr. Fletcher Watson had not provided graduate students at New York University with an informal place to discuss ideas and if my dissertation chairperson, Dr. Judith Klein had not asked provocative questions. We hope the presentations today will stimulate discussion which will help researchers to gain insights into the problems associated with anxiety about science and science teaching.

The initial study at C. W. Post was conducted during the 1977-78 academic year. The researcher investigated the relationships among attitude toward teaching science , anxiety about teaching science and demographic variables (high school and college science and math backgrounds, enjoyment of science and math and prior experiences in science) in preservice elementary teachers enrolled in a sequence of science content courses. (Westerback, 1979) Both attitude toward teaching science and anxiety about teaching science

was changed in a positive direction during the sequence of science courses. Students with positive attitudes tended to have low anxiety levels. Students who reported negative experiences in science had higher initial anxiety scores, but this effect was diminished before the courses ended. The initial study was replicated during the 1978-79 academic year to provide "base line" studies as there were no comparable studies in the literature.

Subsequent studies focus on the study of anxiety rather than both anxiety and attitude because anxiety is more precisely defined and measured than attitude, anxiety is a consistent concern of science educators and very little research has been done on the subject on preservice elementary teachers.

The assessment instrument used in all studies was the State-Trait Anxiety Inventory. The instrument contains two scales, the A-State scale which measured state anxiety, a transitory emotional state which can be influenced by training and the A-Trait scale which measures relatively stable individual differences in anxiety proneness. (Spielberger, Gorsuch and Lushene, 1970). There are presently two forms of the scale, Form X and Form Y. The Y scale has been developed recently and was sent to Westerback by Spielberger prior to publication of the manual for its use. Spielberger states that the X Form contained several items that were more reflective of depression than anxiety and that several items had poor psychometric properties for samples of high school students. (Spielberger, 1979)

Each scale contains 20 self report items like "I feel secure.", "I feel frightened." and "I feel self-confident." (A-State, Form Y) and "I feel nervous and restless.", "I feel satisfied with myself." and "I feel like a failure." (A-Trait, Form Y) Each subject is asked to rate the intensity of his/her feelings.

Dreger (1978) states that the STAI (Form X) is one of the best standardized measures of anxiety, if not the best. Because this scale is designed to measure situational

conditions, test-retest measues are low, ranging from .16 to .50 with a median r of only .32. Coefficient alpha measures of internal consistency for the X form ranged from .82 to .92 (Spielberger, Gorsuch and Lushene, 1970). Westerback found the reliability coefficient for the Y form administered to 103 subjects during the Spring 1982 semester was .95.

Test-retest correlations for the A- Trait, Form X ranged from .73 to .86. (Spielberger, Gorsuch and Lusbene, 1970) Westerback found the coefficent alpha coefficient for the Y form administered to 103 subjects during the Spring 1981 semester was .92.

Correlation coefficient for two administrations of the X and Y forms (94 subjects - October 1980 and 103 subjects - May 1981) ranged from .93 to .94.

The studies conducted during the 1977-78, 1978-79, and 1979-80 academic years at C.W. Post were done with the A-State scale, Form X. All studies conducted since the Fall of 1981 were conducted with both A-State and A-Trait scales of the Y form. Tables 1 and 2 show the means and standard deviations of most administrations of the STAI from Fall 1977 to Spring 1982. It can be seen that when both the X and Y form are given on the same day, the initial A-State scores are higher on Form Y. The difference between the initial X and Y scores is not significant, but the pattern appears to be consistent.

In all studies the headings were changed from "Self Evaluation Questionnaire" to either "How Do You Feel About Teaching Science" or "How Do You Feel About Teaching Minerals and Rocks" for the A-State scale, and "How Do You Feel in General" for the A-Trait scale. These changes were made, with Spielberger's permission, because the researcher felt that the original headings might be perceived by the students as a measure of their emotional stability and not a measure of the feelings about teaching or life in general.

Table 1

MEANS AND STANDARD DEVIATIONS FOR THE STAI (FORM X) FOR PRESERVICE ELEMENTARY TEACHERS AT C. W. POST COLLEGE

		ADMINISTRATIONS			
	N	September	October	December	May
A-STATE					
1977-78	78	48.17 11.34		45.58 10.83	41.86 10.63
1978-79	71	49.90 11.17		42.58 12.76	42.21 12.45
1979-80	92	49.34 11.25		41.78 9.34	42.97 11.12
1980-81	94		45.59 10.78		
1981-82	67	46.18 12.97			
1977-80 Combined	241	49.27 11.37			
Females	223	49.52 11.58			
Males	18	45.38 6.34			
A-TRAIT					
1979-80	92			3 6.57 6.92	
1980-81	94		35.63 8.69		
1981-82	67	34.19 7.35			

Table 2

MEANS AND STANDARD DEVIATIONS FOR THE STAI (FORM Y) FOR PRESERVICE ELEMENTARY TEACHERS AT C.W. POST COLLEGE

		ADMINISTRATIONS				
	N	September	October	December	January	May
A-STATE						
1979-80	92			41.78 9.34		
1980-81	94	53.62 11.70	47.18 11.37	42.05 10.16		
(Subgroup of N=94)	39	54.18 10.81	45.66[a] 9.57	40.80 9.89	42.18 8.60	41.31 11.85
(Subgroup of N=94)	25	53.72 12.16	47.64 10.76	41.60 8.59	41.52 6.82	37.48 8.11
1981-82	67	49.29 13.43				
	27				48.19[b] 12.75	
A-TRAIT						
1979-80	92			36.56 6.92		33.70[c] 7.43
1980-81	94	36.86 7.32	36.42 8.72	35.48 8.70		
(Subgroup of N=94)	39	36.80 6.40	35.82[a] 7.38	35.46 7.81	34.77 8.77	34.26 8.81
(Subgroup of N=94)	25	36.52 8.11	35.24[d] 8.01	35.40 8.89	33.08 7.79	33.44 8.60
1981-82	67	34.84 7.36				
	27				33.74[b] 7.88	

[a]N=38 [b]Initial administration [c]N=91 [d]N=24

The directions, which are critical, should be specific. (Westerback, 1979 and Westerback and Gonzalez, 1982)

Westerback has administered the STAI to 646 subjects (many several times) since the Fall of 1977. Even though the standard deviations for a particular sample may appear high, consecutive trait scores for an individual are amazingly consistant and consecutive state scores rational.

Four consecutive studies on anxiety about teaching science in preservice elementary teachers were conducted at C. W. Post from September 1977 through May 1981. (Westerback, 1982 in review) The purpose of the researcher was to determine: 1. if the increase in instructional time (sequence was increased from 100 minutes per week to 150 minutes per week to 150 minutes per week lecture plus 150 minutes per week laboratory); 2. the order in which students elected courses (physical science - life science) and 3. staffing patterns and/or faculty behavior significantly affected anxiety about teaching science.

One of the most interesting findings was that although 10 different teachers were involved in the study significant differences among the anxiety scores of students in classes taught by different instructors was rare. In only two instances did teacher behavior cause an increase in anxiety. Grading on a curve caused an increase in anxiety because the students perceived they were failing the course. When the teacher discontinued this practice anxiety levels dropped. In another case the apparent emphasis on memorization increased anxiety levels.

It became apparent that although it is interesting to note that anxiety about teaching science can be reduced during a sequence of science content courses, the identification of specific causes of anxiety about teaching science is also important. During the 1980-81

academic year the Research Committee of C. W. Post College provided funding for David Roll to direct a Science Anxiety Workshop. (Roll, 1982 in progress) Although 50% of the 119 students eligible to participate in this study indicated interest in attending the workshops, only 10 students attended the first session of the workshop in the fall semester. The small response obviated any attempts at experimental research, but the workshop was conducted as a demonstration and pilot study. The problem of finding students to volunteer for analogue or directed clinical interventions in not unique to C. W. Post College. Although Roll found the results sufficient to encourage more systematic investigation, they must be viewed with caution. First, without a randomly assigned control group, the amount of change due to variable other than the intervention cannot be assessed. Nor can the possibility of regression toward the mean be eliminated. Second, the participants were subject to sensitization and demand characteristics. The pre-test in combination with participation in the workshop could easily lead to a bias on the self-report measure used to evaluate the outcome. Third, there was sufficient subject mortality.

So, the question remains unanswered. Can students of science who are anxious about that subject be taught coping skills to reduce that anxiety and increase their competency in the subject as a result? Similar interventions have been successful with related material. (Suinn and Richardson, 1971; Richardson and Suinn, 1973). With one exception the consumer evaluations of the anxiety workshop were highly positive — even for those subjects who did not complete all the sessions. The averaged data from the study at C. W. Post represented changes of a large enough magnitude in the appropriate direction to warrant further investigation. All that remains to be found are the students who are anxious about science and willing to attend the free and voluntary workshops. Therefore, a study was designed to determine the

variables influencing willingness to participate in such workshops. The sixty students deemed to have the greatest amount of anxiety specifically related to science according to the STAI pre-test scores were determined. The scores used to determine the rankings was obtained by adding the A-State score to the difference between the A-State and A-Trait scores. Thirty-five percent of the students responded to a questionnaire related to reasons for not attending the workshop and suggestions for changes in recruitment procedures. The respondents reported that lack of time was the greatest deterent and they responded very favorably to the idea of having the anxiety control techniques taught as part of their General Science laboratory sequence.

An internally valid experiment could be conducted in laboratory sections of the course without violating ethical principles of freedom of choice and informed consent. Serious consideration was given to this idea. However, the study on fulfillment of expectations for identification of minerals and rocks and anxiety about teaching minerals and rocks (Westerback and Gonzalez, 1982) has, at least, postponed this consideration. The Westerback and Gonzalez study implies that anxiety reduction within the classroom setting, by the classroom teacher may be the most effective means to reduce anxiety about science and science teaching. In the first place all students would benefit form this approach, instead of a limited number of students who volunteer for psychological intervention. Second, and not less important, if the teacher and/or the classroom situation is the stimulus which provokes anxiety, then that environment would be the most effective environment for anxiety reduction, provided the teacher is properly trained.

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